Monthly Notices of the Royal Astronomical Society 2018 vol.480 N4, pages 4489-4504

Optical observations of 'hot' novae returning to quiescence

Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

© 2018 The Author(s). We have monitored the return to quiescence of novae previously observed in outburst as supersoft X-ray sources, using optical photometry of the intermediate polar (IP)V4743 Sgr and the candidate IP V2491 Cyg, and optical spectroscopy of these two and seven other systems. Our sample includes classical and recurrent novae, short-period (few hours), intermediateperiod (1-2days) and long-period (symbiotic) binaries. The light-curves of V4743 Sgr and V2491 Cyg present clear periodic modulations. For V4743 Sgr, the modulation occurs with the beat of the rotational and orbital periods. If the period measured for V2491 Cyg is also the beat of these two periods, the orbital period should be almost 17 h. The recurrent nova T Pyx already shows fragmentation of the nebular shell less than 3 yr after outburst. While this nova still had strong [OIII] at this post-outburst epoch, these lines had faded after 3 to 7 yr in all the others. We did not find any difference in the ratio of equivalent widths of highionization/ excitation lines to that of the Hβ line in novae with short and long orbital periods, indicating that irradiation does not trigger a high mass-transfer rate m˙ from secondaries with small orbital separation. An important difference between the spectra of RS Oph and V3890 Sgr and those of many symbiotic persistent supersoft sources is the absence of forbidden coronal lines. In combination with the X-ray turn-off, we interpret this as an indication that mass transfer in symbiotic recurrent novae is intermittent.

http://dx.doi.org/10.1093/MNRAS/STY2061

Keywords

Binaries: symbiotic, Cataclysmic variables, HV Cet, KT Eri, Line: profiles, RS Oph, Stars: novae, T Pyx, U Sco, V2491 Cyg, V382 Vel, V3890 Sgr, V4743 Sgr, White dwarfs

References

[1] Adamakis S., Eyres S. P. S., Sarkar A., Walsh R. W., 2011, MNRAS, 414, 2195

[2] Augusto A., Diaz M. P., 2003, AJ, 125, 3349

[3] Aydi E. et al., 2018, MNRAS, 480, 582

[4] Baklanov A., Pavlenko E., Berezina E., 2008, Astron. Telegram, 1514, 1

[5] Balman Ş ., Retter A., Bos M., 2006, AJ, 131, 2628

[6] Barry R. K., Mukai K., Sokoloski J. L., DanchiW. C., Hachisu I., Evans A., Gehrz R., Mikolajewska J., 2008, in Evans A., Bode M. F., O'Brien T. J., Darnley M. J., eds, Astronomical Society of the Pacific Conference Series Vol. 401, RS Ophiuchi (2006) and the Recurrent Nova Phenomenon. Astron. Soc. Pac., San Francisco, p. 52

[7] Beardmore A. P. et al., 2012, A&A, 545, A116

[8] Bianchini A., Canterna R., Desidera S., Garcia C., 2003, PASP, 115, 474

[9] Bode M. F. et al., 2006, ApJ, 652, 629
[10] Booth R. A., Mohamed S., Podsiadlowski P., 2016, MNRAS, 457, 822
[11] Bos M., Retter A., McCormick J., Velthuis F., 2001, IAU Circ., 7610
[12] Bowen I. S., 1934, PASP, 46, 146
[13] Bowen I. S., 1935, ApJ, 81, 1
[14] Brandi E., Quiroga C., Mikolajewska J., Ferrer O. E., García L. G., 2009, A&A, 497, 815
[15] Burstein D., Heiles C., 1982, AJ, 87, 1165
[16] Cardelli J. A., Clayton G. C., Mathis J. S., 1989, in Allamandola L. J., TielensA.G.G.M., eds, Proc. IAUSymp. 135, Interstellar Dust.Kluwer, Dordrecht, p. 5
[17] Chesneau O. et al., 2007, A&A, 464, 119
[18] Darnley M. J., Ribeiro V. A. R. M., Bode M. F., Munari U., 2011, A&A, 530, A70
[19] Deeming T. J., 1975, Ap&SS, 36, 137
[20] Della Valle M., Pasquini L., Daou D.,Williams R. E., 2002, A&A, 390, 155
[21] Dobrotka A., Ness J.-U., 2010, MNRAS, 405, 2668
[22] Drake A. J. et al., 2009, ApJ, 696, 870
[23] Drake A. J. et al., 2009, Astron. Telegram, 1940
[24] Drake A. J. et al., 2009, Astron. Telegram, 2331
[25] Duerbeck H. W., 1987, Space Sci. Rev., 45, 1
[26] Dürbeck H. W., Dümmler R., Seitter W. C., Leibowitz E. M., Shara M. M., 1993, Messenger, 71, 19
[27] Eyres S. P. S. et al., 2009, MNRAS, 395, 1533
[28] FerrarioL., 1991, in Bertout C.,Collin-Souffrin S., Lasota J. P., eds, Poc. IAU Colloq. 129, The 6th Institute d'Astrophysique de Paris (IAP) Meeting: Structure and Emission Properties of Accretion Disks. Kluwer, Dordrecht, p. 425
[29] Gilmore A. C., Kilmartin P. M., 1999, IAU Circ., 7238
[30] Gilmozzi R., Selvelli P., 2007, A&A, 461, 593
[31] González-Riestra R., 2015, Acta Polytechnica CTU Proc., 2, 252
[32] Goranskij V. P., Metlova N. V., 2009, Astron. Telegram, 1938
[33] Greiner J., Orio M., Schartel N., 2003, A&A, 405, 703
[34] Hachisu I., Kato M., 2009, ApJ, 694, L103
[35] Hachisu I., Kato M., Kato T., Matsumoto K., Nomoto K., 2000, ApJ, 534, L189
[36] Haseda K., West D., Yamaoka H., Masi G., 2002, IAU Circ., 7975, 1
[37] Hounsell R. et al., 2010, ApJ, 724, 480
[38] Hounsell R. et al., 2010, Astron. Telegram, 2558
[39] Ibarra A. et al., 2009, A&A, 497, L5
[40] Iijima T., 2009, A&A, 505, 287
[41] Imamura K., Tanabe K., 2012, PASJ, 64
[42] Itagaki K., 2009, Cent. Bur. Elect. Teleg., 2050
[43] Johnston H. M., Kulkarni S. R., 1992, ApJ, 396, 267
[44] Jurdana-Sepic R., Munari U., 2008, Inf. Bull. Variable Stars, 5839, 1
[45] Jurdana-Šepić R., Ribeiro V. A. R. M., Darnley M. J., Munari U., Bode M. F., 2012, A&A, 537, A34
[46] Kang T. W., Retter A., Liu A., Richards M., 2006, AJ, 132, 608
[47] Kastner S. O., Bhatia A. K., 1996, MNRAS, 279, 1137
[48] Kilmartin P., Gilmore A., Jones A. F., Pearce A., 1990, IAU Circ., 5002
[49] Kovetz A., Prialnik D., Shara M. M., 1988, ApJ, 325, 828
[50] Krautter J., 2008, in Evans A., Bode M. F., O'Brien T. J., Darnley M. J., eds, Astronomical Society of the Pacific Conference Series Vol. 401, RS Ophiuchi (2006) and the Recurrent Nova Phenomenon. Astron. Soc. Pac., San Francisco, p. 139
[51] Landolt A. U., 1992, AJ, 104, 340
[52] Leibowitz E., OrioM., Gonzalez-Riestra R., Lipkin Y., Ness J.-U., Starrfield S., Still M., Tepedelenlioglu E., 2006, MNRAS, 371, 424
[53] McClintock J. E., Canizares C. R., Tarter C. B., 1975, ApJ, 198, 641
[54] Mikolajewska J., Shara M. M., 2017, ApJ, 847, 99

[55] Morales-Rueda L., Still M. D., Roche P., 1999, MNRAS, 306, 753
[56] Munari U., Siviero A., Dallaporta S., Cherini G., Valisa P., Tomasella L., 2011, New A stron., 16, 209
[57] Nakano S. et al., 2008, IAU Circ., 8934, 1
[58] Naylor T., Charles P. A., Mukai K., Evans A., 1992, MNRAS, 258, 449
[59] Nelson T., Orio M., Cassinelli J. P., Still M., Leibowitz E., Mucciarelli P., 2008, ApJ, 673, 1067
[60] Ness J.-U. et al., 2003, ApJ, 594, L127
[61] Ness J.-U., Starrfield S., Jordan C., Krautter J., Schmitt J. H. M. M., 2005, MNRAS, 364, 1015
[62] Ness J.-U. et al., 2007, ApJ, 665, 1334
[63] Ness J.-U. et al., 2009, AJ, 137, 3414
[64] Ness J.-U. et al., 2011, ApJ, 733, 70
[65] Ness J.-U. et al., 2012, ApJ, 745, 43
[66] Ness J.-U. et al., 2014, Astron. Telegram, 6147
[67] Nielbock M., Schmidtobreick L., 2003, A&A, 400, L5
[68] O'Brien T. J. et al., 2006, Nature, 442, 279
[69] Orio M., 2012, Bull. Astron. Soc. India, 40, 333
[70] Orio M., Covington J., Ögelman H., 2001, A&A, 373, 542
[71] Orio M., Covington J., Ögelman H., 2001, A&A, 373, 542
[72] Orio M., Zezas A., Munari U., Siviero A., Tepedelenlioglu E., 2007, ApJ, 661, 1105
[73] Orio M. et al., 2013, MNRAS, 429, 1342
[74] Orio M. et al., 2017, MNRAS, 470, 2212
[75] Page K. L. et al., 2010, MNRAS, 401, 121
[76] Pagnotta A. et al., 2015, ApJ, 811, 32
[77] Patat F., Chugai N. N., Podsiadlowski P., Mason E., Melo C., Pasquini L., 2011, A&A, 530, A63
[78] Patterson J. et al., 1998, PASP, 110, 380
[79] Patterson J. et al., 2014, inWoudt P. A., Ribeiro V. A. R.M., eds, Astronomical Society of the Pacific Conference Series Vol. 490, Stellar Novae: Past and Future Decades. Astron. Soc. Pac., San Francisco, p. 35
[80] Pavlenko Y. V. et al., 2016, MNRAS, 456, 181
[81] Pejcha O., Prieto J. L., Denney K., 2008, Astron. Telegram, 1825
[82] Prieto J. L., Denney K., Pejcha O., Wagner R. M., 2008, Astron. Telegram, 1835
[83] Ragan E. et al., 2009, Astron. Telegram, 2327
[84] Rauch T., Orio M., Gonzales-Riestra R., Nelson T., Still M., Werner K., Wilms J., 2010, ApJ, 717, 363
[85] Ribeiro V. A. R. M. et al., 2009, ApJ, 703, 1955
[86] Ribeiro V. A. R. M., Darnley M. J., Bode M. F., Munari U., Harman D. J., Steele I. A., Meaburn J., 2011, MNRAS, 412, 1701
[87] Richards M. T., Kang T. W., Retter A., Liu A., 2005, in Am. Astron. Soc. Meeting Abstracts. 207.7020
[88] Ringwald F. A., Naylor T., Mukai K., 1996, MNRAS, 281, 192
[89] Rudy R. J., Lynch D. K., Russell R. W., Woodward C. E., Covey K., 2008, IAU Circ., 8938, 2
[90] Scargle J. D., 1982, ApJ, 263, 835
[91] Schaefer B. E., 1990, ApJ, 355, L39
[92] Schaefer B. E., 2010, ApJS, 187, 275
[93] Schaefer B. E. et al., 2010, AJ, 140, 925
[94] Schaefer B. E. et al., 2013, ApJ, 773, 55
[95] Schwarz G. J. et al., 2008, Astron. Telegram, 1847
[96] Schwarz G. J. et al., 2011, ApJS, 197, 31
[97] Selvelli P., Cassatella A., Gilmozzi R., González-Riestra R., 2008, A&A, 492, 787
[98] Shara M. M., Livio M., Moffat A. F. J., Orio M., 1986, ApJ, 311, 163
[99] Shara M. M., Zurek D. R.,Williams R. E., Prialnik D., Gilmozzi R., Moffat A. F. J., 1997, AJ, 114, 258
[100] Shore S. N. et al., 2003, AJ, 125, 1507
[101] Shugarov S. Y., Chochol D., Volkov I. M., Zemko P. O., 2010, in Sterken C., Samus N., Szabados L., eds, Variable Stars, The Galactic halo and Galaxy Formation. Sternberg Astronomical Institute of Moscow University, Russia, Moscow, p. 198
[102] Sokoloski J. L., Rupen M. P., Mioduszewski A. J., 2008, ApJ, 685, L137

[103] Strope R. J., Schaefer B. E., Henden A. A., 2010, AJ, 140, 34

[104] Surina F., Hounsell R. A., Bode M. F., Darnley M. J., Harman D. J., Walter F. M., 2014, AJ, 147, 107

[105] Takei D., Ness J.-U., Tsujimoto M., Kitamoto S., Drake J. J., Osborne J. P., Takahashi H., Kinugasa K., 2011, PASJ, 63, 729

[106] Thoroughgood T. D., Dhillon V. S., Littlefair S. P., Marsh T. R., Smith D. A., 2001, MNRAS, 327, 1323

[107] Tofflemire B. M., Orio M., Page K. L., Osborne J. P., Ciroi S., Cracco V., Di Mille F., Maxwell M., 2013, ApJ, 779, 22

[108] Tomov T., Swierczynski E., Mikolajewski M., Ilkiewicz K., 2015, A&A, 576, A119

[109] Toraskar J.,Mac LowM.-M., Shara M. M., Zurek D. R., 2013, ApJ, 768, 48

[110] Vanderburg A., Johnson J. A., 2014, PASP, 126, 948

[111] Vanlandingham K.M., Schwarz G., Starrfield S.,Woodward C.,Wagner M., Ness J., Helton A., 2007, in Am. Astron. Soc. Meeting Abstracts, 210, 99

[112] Vaytet N. M. H., O'Brien T. J., Page K. L., Bode M. F., Lloyd M., Beardmore A. P., 2011, ApJ, 740, 5

[113] Wagner R. M., Steinfadt J., Bond H. E., Hooper E., Karam A., Rohrbach J., Schwarz G., Starrfield S., 2005, in Am. Astron. Soc. Meeting Abstracts, 207.7023

[114] Williams R. E., Ferguson D. H., 1983, in Livio M., Shaviv G., eds, Astrophysics and Space Science Library Vol. 101, IAU Colloq. 72, Cataclysmic Variables and Related Objects. Kluwer, Dordrecht, p. 97

[115] Williams P., Lee S., Pearce A., Gilmore A. C., Pollard K. R., McSaveney J. A., Kilmartin P. M., Caldwell P., 1999, IAU Circ., 7176

[116] Wolf W. M., Bildsten L., Brooks J., Paxton B., 2013, ApJ, 777, 136

[117] Woodward C. E., Wooden D. H., Pina R. K., Fisher R. S., 1999, IAU Circ., 7220

[118] Worters H. L., Rushton M. T., 2014, MNRAS, 442, 2637

[119] Zamanov R. K., 2011, Bulg. Astron. J., 17, 59

[120] Zemko P., Mukai K., Orio M., 2015, ApJ, 807, 61

[121] Zemko P., Orio M., Mukai K., Bianchini A., Ciroi S., Cracco V., 2016, MNRAS, 460, 2744